

SN54173, SN54LS173A, SN74173, SN74LS173A

4-BIT D-TYPE REGISTERS

WITH 3-STATE OUTPUTS

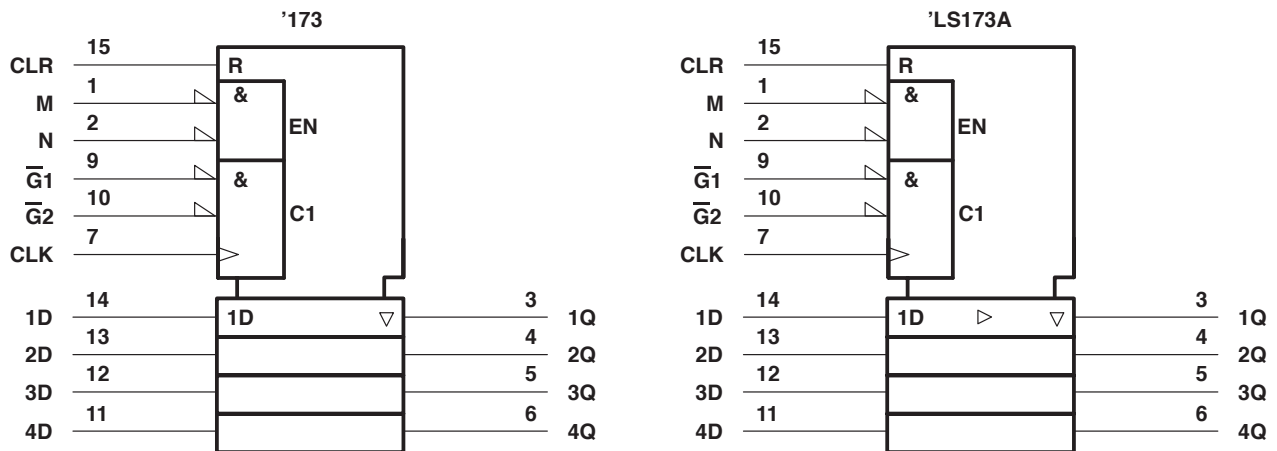
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FUNCTION TABLE

		INPUTS			OUTPUT Q
CLR	CLK	DATA ENABLE		DATA D	
		$\bar{G}1$	$\bar{G}2$		
H	X	X	X	X	L
L	L	X	X	X	Q_0
L	↑	H	X	X	Q_0
L	↑	X	H	X	Q_0
L	↑	L	L	L	L
L	↑	L	L	H	H

When either M or N (or both) is (are) high, the output is disabled to the high-impedance state; however, sequential operation of the flip-flops is not affected.

logic symbol†

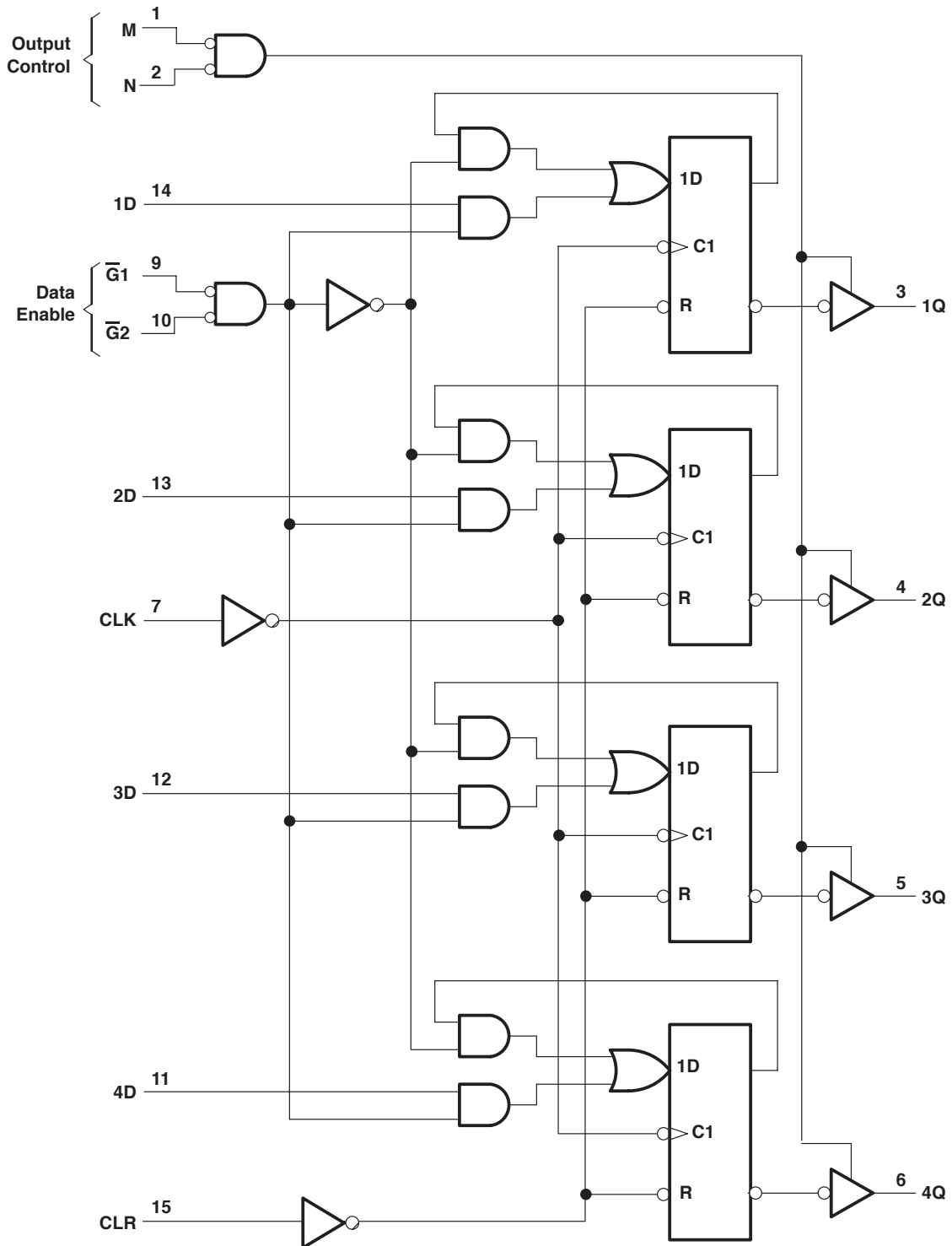


† This symbol is in accordance with ANSI/IEEE Standard 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

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logic diagram (positive logic)

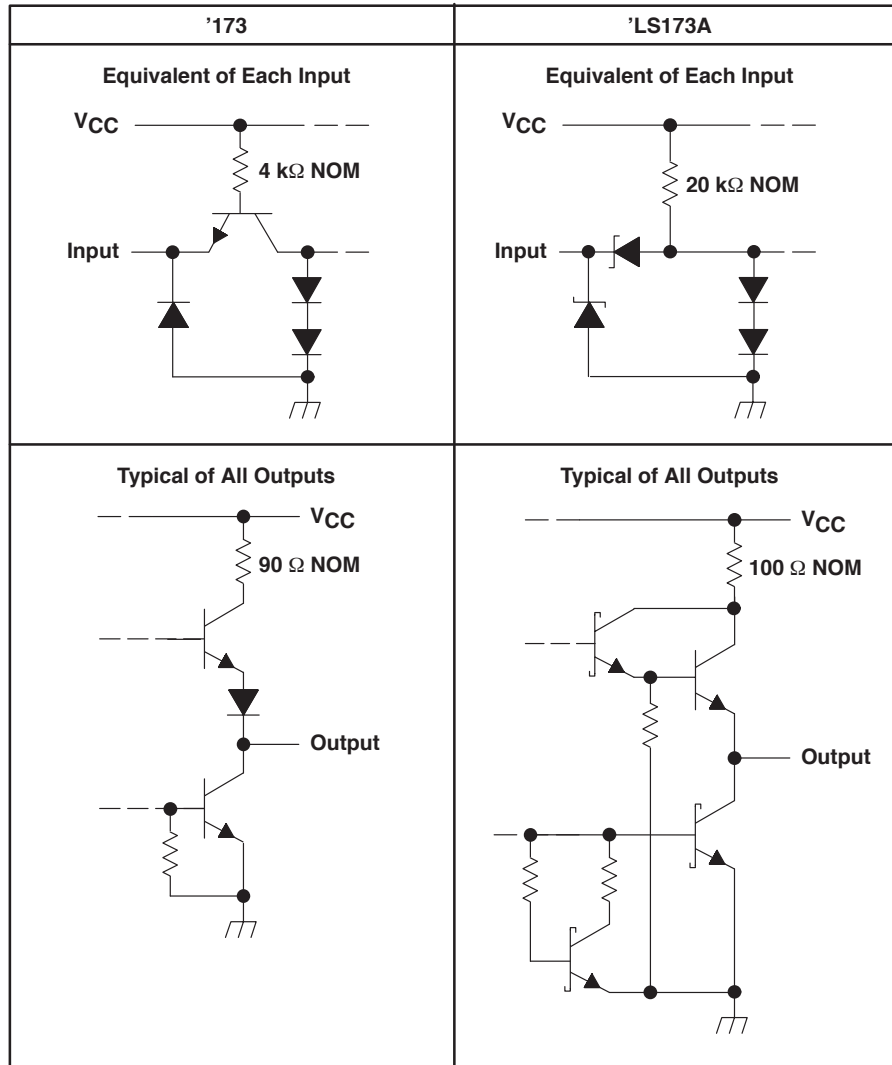


Pin numbers shown are for D, J, N, and W packages.

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schematics of inputs and outputs



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1)	–0.5 V to 7 V
Input voltage: '173	–0.5 V to 5.5 V
'LS173A	–0.5 V to 7 V
Off-state output voltage	–0.5 V to 5.5 V
Package thermal impedance, θ_{JA} (see Note 2): D package	113°C/W
N package	78°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Voltage values are with respect to network ground terminal.

2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.



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recommended operating conditions (see Note 3)

		SN54173			SN74173			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current			-2			-5.2	mA
I _{OL}	Low-level output current			16			16	mA
T _A	Operating free-air temperature	-55		125	0		70	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54173			SN74173			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V _{IH}	High-level input voltage	2			2			V	
V _{IL}	Low-level input voltage			0.8			0.8	V	
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -12 mA		-1.5			-1.5	V	
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, V _{IH} = 2 V, I _{OH} = MAX		2.4			2.4	V	
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, V _{IH} = 2 V, I _{OL} = 16 mA					0.4	V	
I _{O(off)}	Off-state (high-impedance state) output current	V _{CC} = MAX, V _{IH} = 2 V, V _O = 2.4 V		150			40	μA	
		V _O = 0.4 V		-150			-40		
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 5.5 V		1			1	mA	
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.4 V		40			40	μA	
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V		-1.6			-1.6	mA	
I _{OS}	Short-circuit output current§	V _{CC} = MAX		-30			-70	mA	
I _{CC}	Supply current	V _{CC} = MAX, See Note 4		50	72		50	72	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

NOTE 4: I_{CC} is measured with all outputs open; CLR grounded, following momentary connection to 4.5 V, N, $\overline{G1}$, $\overline{G2}$, and all data inputs grounded; and CLK and M at 4.5 V.

timing requirements over recommended operating conditions (unless otherwise noted)

		SN54173		SN74173		UNIT
		MIN	MAX	MIN	MAX	
f _{clock}	Input clock frequency		25		25	MHz
t _w	Pulse duration	CLK or CLR		20	20	ns
t _{su}	Setup time	Data enable ($\overline{G1}$, $\overline{G2}$)		17	17	ns
		Data		10	10	
		CLR (inactive state)		10	10	
t _h	Hold time	Data enable ($\overline{G1}$, $\overline{G2}$)		2	2	ns
		Data		10	10	



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switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 400\ \Omega$ (see Figure 1)

PARAMETER		TEST CONDITIONS	SN54173			SN74173			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
f_{max}	Maximum clock frequency	$C_L = 50\text{ pF}$	25	35		25	35		MHz	
t_{PHL}	Propagation delay time, high-to-low-level output from clear input			18	27		18	27	ns	
t_{PLH}	Propagation delay time, low-to-high-level output from clock input			28	43		28	43	ns	
t_{PHL}	Propagation delay time, high-to-low-level output from clock input			19	31		19	31		
t_{PZH}	Output enable time to high level			7	16	30	7	16	30	ns
t_{PZL}	Output enable time to low level			7	21	30	7	21	30	
t_{PHZ}	Output disable time from high level	$C_L = 5\text{ pF}$	3	5	14	3	5	14	ns	
t_{PLZ}	Output disable time from low level			3	11	20	3	11		20



SN54173, SN54LS173A, SN74173, SN74LS173A 4-BIT D-TYPE REGISTERS WITH 3-STATE OUTPUTS

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recommended operating conditions

		SN54LS173A			SN74LS173A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current			-1			-2.6	mA
I _{OL}	Low-level output current			12			24	mA
T _A	Operating free-air temperature	-55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54LS173A			SN74LS173A			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	UNIT	
V _{IH}	High-level input voltage	2			2			V	
V _{IL}	Low-level input voltage	0.7			0.8			V	
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -18 mA			-1.5			V	
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{ILmax} , I _{OH} = MAX			2.4 3.4			V	
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OL} = 12 mA		0.25 0.4		0.25 0.4		V	
		I _{OL} = 24 mA				0.35 0.5		V	
I _{O(off)}	Off-state (high-impedance state) output current	V _{CC} = MAX, V _{IH} = 2 V, V _O = 2.7 V		20		20		V	
		V _O = 0.4 V		-20		-20			
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 7 V			0.1			mA	
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.7 V			20			μA	
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V			-0.4			mA	
I _{OS}	Short-circuit output current§	V _{CC} = MAX			-30 -130		-30 -130		mA
I _{CC}	Supply current	V _{CC} = MAX, See Note 4			19 30		19 24		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

NOTE 4: I_{CC} is measured with all outputs open; CLR grounded, following momentary connection to 4.5 V, N, $\overline{G1}$, $\overline{G2}$, and all data inputs grounded; and CLK and M at 4.5 V.

timing requirements over recommended operating conditions (unless otherwise noted)

		SN54LS173A		SN74LS173A		UNIT
		MIN	MAX	MIN	MAX	
f _{clock}	Input clock frequency	30		25		MHz
t _w	Pulse duration	CLK or CLR		25		ns
t _{su}	Setup time	Data enable ($\overline{G1}$, $\overline{G2}$)		35		ns
		Data		17		
		CLR (inactive state)		10		
t _h	Hold time	Data enable ($\overline{G1}$, $\overline{G2}$)		0		ns
		Data		3		



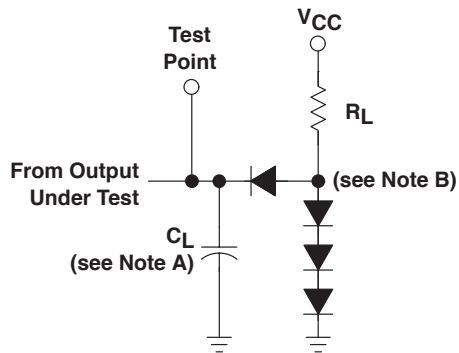
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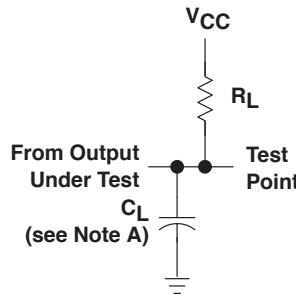
switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 667\ \Omega$ (see Figure 2)

PARAMETER		TEST CONDITIONS	SN54LS173A			SN74LS173A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
f_{max}	Maximum clock frequency	$C_L = 45\text{ pF}$	30	50		30	50		MHz
t_{PHL}	Propagation delay time, high-to-low-level output from clear input			26	35		26	35	ns
t_{PLH}	Propagation delay time, low-to-high-level output from clock input			17	25		17	25	ns
t_{PHL}	Propagation delay time, high-to-low-level output from clock input			22	30		22	30	
t_{PZH}	Output enable time to high level			15	23		15	23	ns
t_{PZL}	Output enable time to low level			18	27		18	27	
t_{PHZ}	Output disable time from high level	$C_L = 5\text{ pF}$		11	20		11	20	ns
t_{PLZ}	Output disable time from low level			11	17		11	17	

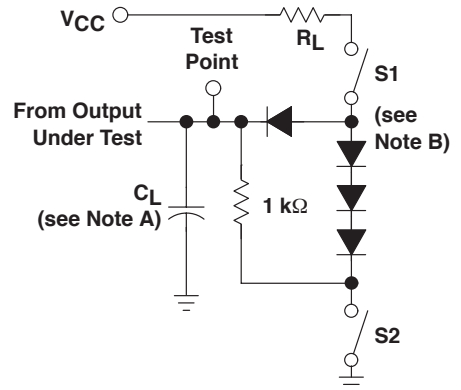
**PARAMETER MEASUREMENT INFORMATION
 SERIES 54/74 AND 54S/74S DEVICES**



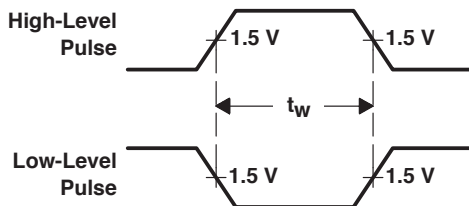
**LOAD CIRCUIT
 FOR 2-STATE TOTEM-POLE OUTPUTS**



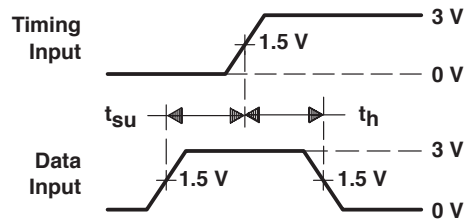
**LOAD CIRCUIT
 FOR OPEN-COLLECTOR OUTPUTS**



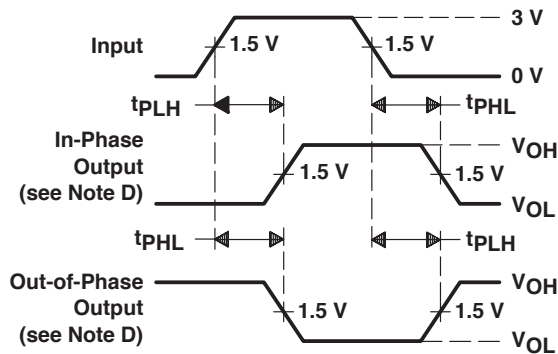
**LOAD CIRCUIT
 FOR 3-STATE OUTPUTS**



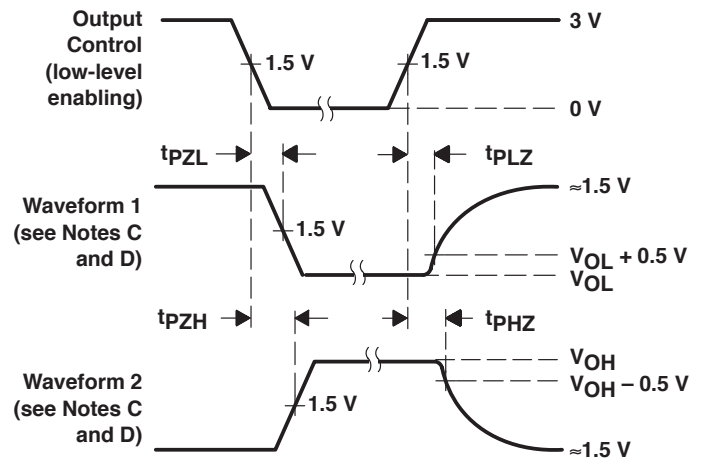
**VOLTAGE WAVEFORMS
 PULSE DURATIONS**



**VOLTAGE WAVEFORMS
 SETUP AND HOLD TIMES**



**VOLTAGE WAVEFORMS
 PROPAGATION DELAY TIMES**



**VOLTAGE WAVEFORMS
 ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS**

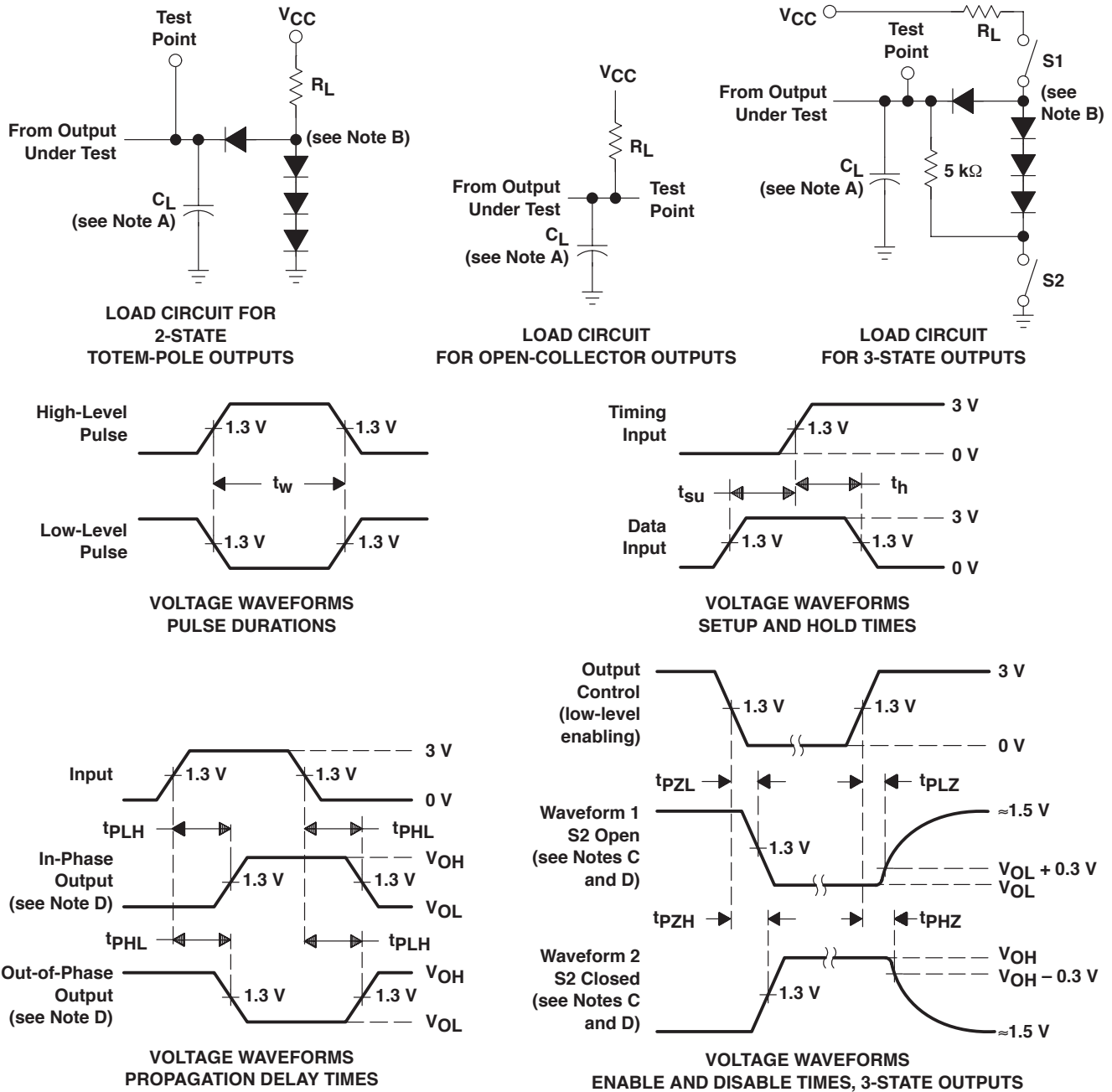
- NOTES: A. C_L includes probe and jig capacitance.
 B. All diodes are 1N3064 or equivalent.
 C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open and S2 is closed for t_{PZH} ; S1 is closed and S2 is open for t_{PZL} .
 E. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O \approx 50 \Omega$, t_r and $t_f \leq 7$ ns for Series 54/74 devices and t_r and $t_f \leq 2.5$ ns for Series 54S/74S devices.
 F. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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4-BIT D-TYPE REGISTERS
WITH 3-STATE OUTPUTS

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PARAMETER MEASUREMENT INFORMATION
SERIES 54LS/74LS DEVICES



- NOTES: A. C_L includes probe and jig capacitance.
 B. All diodes are 1N3064 or equivalent.
 C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open and S2 is closed for t_{pZH} ; S1 is closed and S2 is open for t_{pZL} .
 E. Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
 F. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O \approx 50 \Omega$, $t_r \leq 15$ ns, $t_f \leq 6$ ns.
 G. The outputs are measured one at a time with one input transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms

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DM74LS86

Quad 2-Input Exclusive-OR Gate

General Description

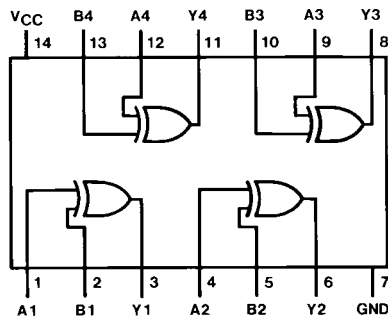
This device contains four independent gates each of which performs the logic exclusive-OR function.

Ordering Code:

Order Number	Package Number	Package Description
DM74LS86M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
DM74LS86SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS86N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

$$Y = A \oplus B = \bar{A}B + A\bar{B}$$

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

H = HIGH Logic Level
L = LOW Logic Level

Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			-0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = -18 mA			-1.5	V
V _{OH}	HIGH Level Output Voltage	V _{CC} = Min, I _{OH} = Max, V _{IL} = Max, V _{IH} = Min	2.7	3.4		V
V _{OL}	LOW Level Output Voltage	V _{CC} = Min, I _{OL} = Max, V _{IL} = Max, V _{IH} = Min		0.35	0.5	V
		I _{OL} = 4 mA, V _{CC} = Min		0.25	0.4	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 7V			0.2	mA
I _{IH}	HIGH Level Input Current	V _{CC} = Max, V _I = 2.7V			40	μA
I _{IL}	LOW Level Input Current	V _{CC} = Max, V _I = 0.4V			-0.6	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 3)	-20		-100	mA
I _{CCH}	Supply Current with Outputs HIGH	V _{CC} = Max (Note 4)		6.1	10	mA
I _{CCL}	Supply Current with Outputs LOW	V _{CC} = Max (Note 5)		9	15	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 4: I_{CCH} is measured with all outputs OPEN, one input at each gate at 4.5V, and the other inputs grounded.

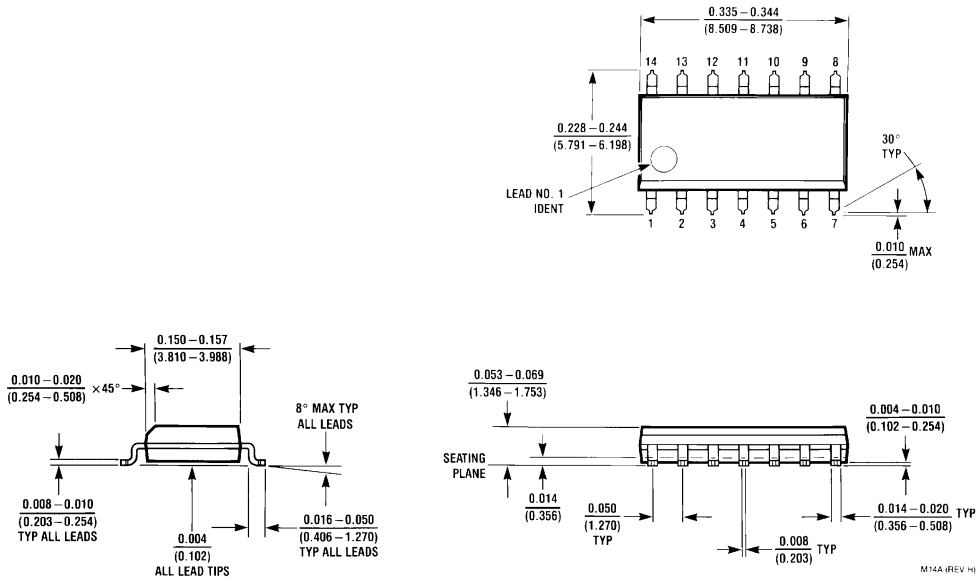
Note 5: I_{CCL} is measured with all outputs OPEN and all inputs grounded.

Switching Characteristics

at V_{CC} = 5V and T_A = 25°C

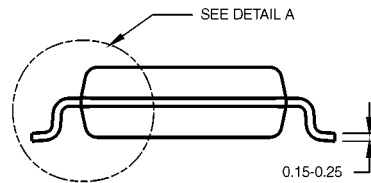
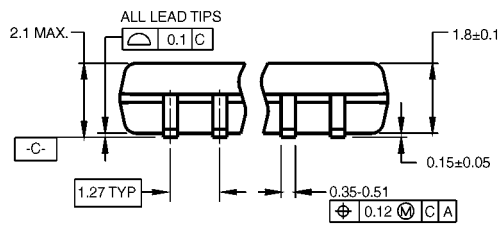
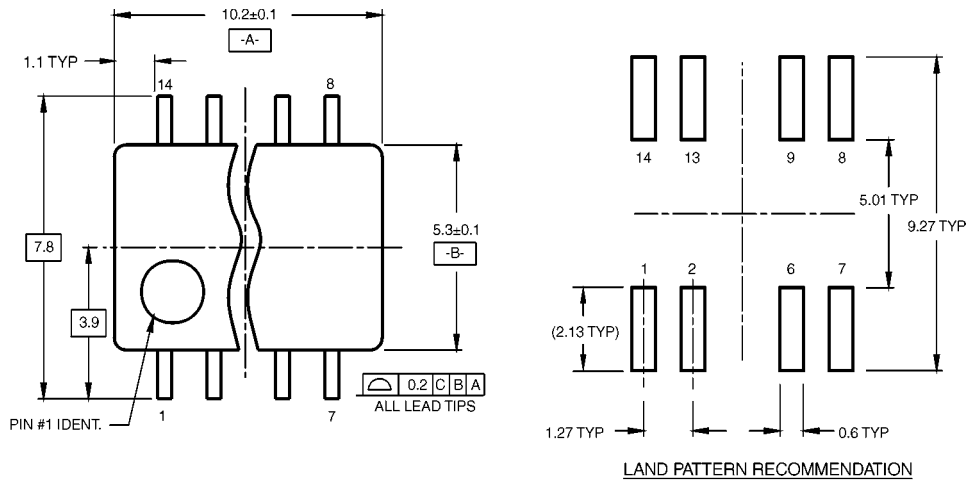
Symbol	Parameter	Conditions	R _L = 2 kΩ				Units
			C _L = 15 pF		C _L = 50 pF		
			Min	Max	Min	Max	
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	Other Input		18		23	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	Low		17		21	ns
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	Other Input		10		15	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	High		12		15	ns

Physical Dimensions inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A**

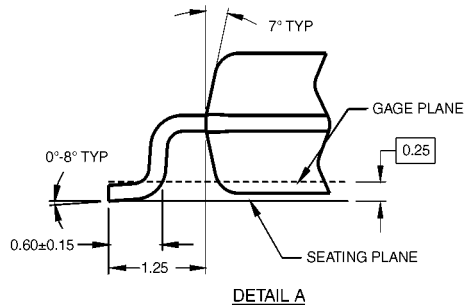
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

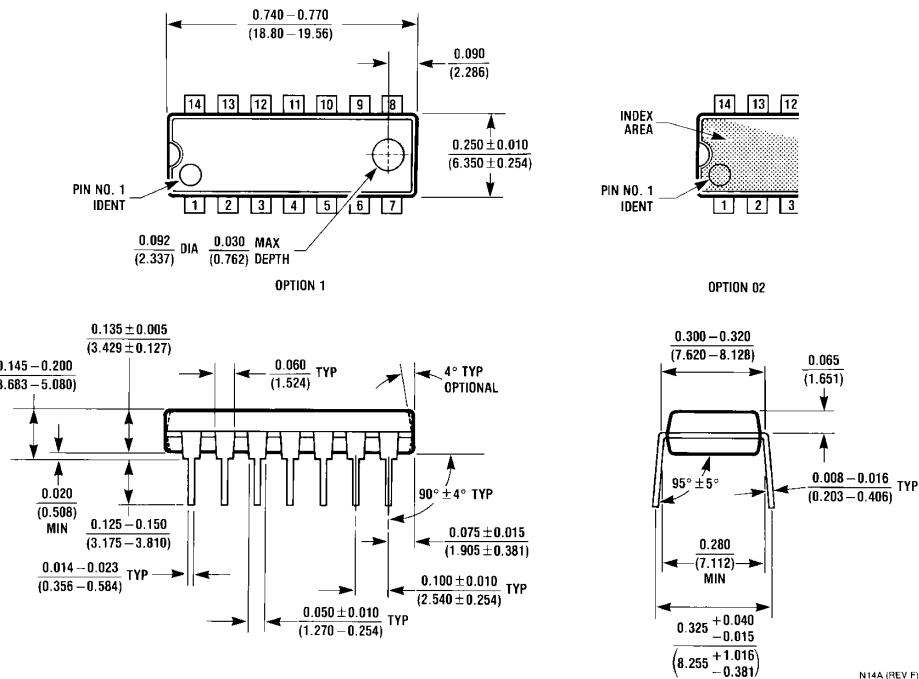
- NOTES:
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 B. DIMENSIONS ARE IN MILLIMETERS.
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1



**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
 Package Number M14D**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N14A

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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DM74LS245 3-STATE Octal Bus Transceiver

General Description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control function implementation minimizes external timing requirements.

The device allows data transmission from the A Bus to the B Bus or from the B Bus to the A Bus depending upon the logic level at the direction control (DIR) input. The enable input (\bar{G}) can be used to disable the device so that the buses are effectively isolated.

Features

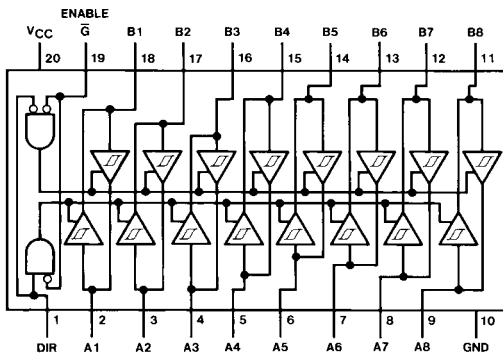
- Bi-Directional bus transceiver in a high-density 20-pin package
- 3-STATE outputs drive bus lines directly
- PNP inputs reduce DC loading on bus lines
- Hysteresis at bus inputs improve noise margins
- Typical propagation delay times, port-to-port 8 ns
- Typical enable/disable times 17 ns
- I_{OL} (sink current)
24 mA
- I_{OH} (source current)
-15 mA

Ordering Code:

Order Number	Package Number	Package Description
DM74LS245WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
DM74LS245SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS245N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

Enable \bar{G}	Direction Control DIR	Operation
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Isolation

H = HIGH Level
L = LOW Level
X = Irrelevant

Absolute Maximum Ratings (Note 1)

Supply Voltage	7V
Input Voltage	
DIR or \bar{G}	7V
A or B	5.5V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	HIGH Level Input Voltage	2			V
V_{IL}	LOW Level Input Voltage			0.8	V
I_{OH}	HIGH Level Output Current			-15	mA
I_{OL}	LOW Level Output Current			24	mA
T_A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

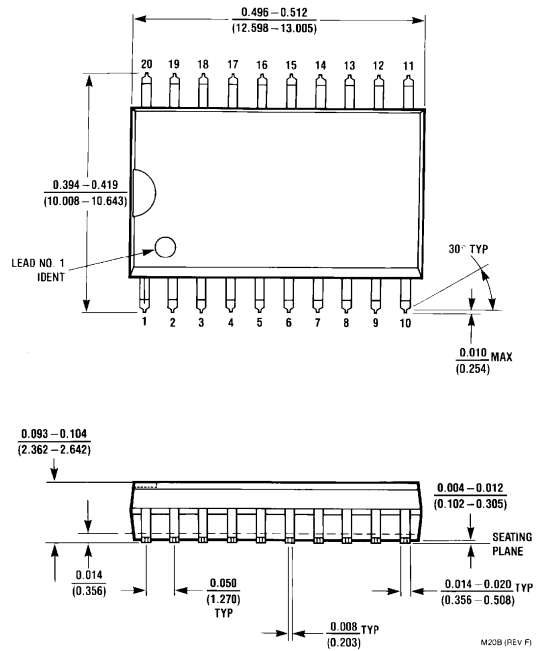
Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units	
V_I	Input Clamp Voltage	$V_{CC} = \text{Min}, I_I = -18 \text{ mA}$			-1.5	V	
HYS	Hysteresis ($V_{T+} - V_{T-}$)	$V_{CC} = \text{Min}$	0.2	0.4		V	
V_{OH}	HIGH Level Output Voltage	$V_{CC} = \text{Min}, V_{IH} = \text{Min}$ $V_{IL} = \text{Max}, I_{OH} = -1 \text{ mA}$	2.7			V	
		$V_{CC} = \text{Min}, V_{IL} = \text{Min}$ $V_{IL} = \text{Max}, I_{OH} = -3 \text{ mA}$	2.4	3.4			
		$V_{CC} = \text{Min}, V_{IH} = \text{Min}$ $V_{IL} = 0.5 \text{ V}, I_{OH} = \text{Max}$	2				
V_{OL}	LOW Level Output Voltage	$V_{CC} = \text{Min}$ $V_{IL} = \text{Max}$ $V_{IH} = \text{Min}$	$I_{OL} = 12 \text{ mA}$ $I_{OL} = \text{Max}$		0.4 0.5	V	
I_{OZH}	Off-State Output Current, HIGH Level Voltage Applied	$V_{CC} = \text{Max}$ $V_{IL} = \text{Max}$	$V_O = 2.7 \text{ V}$		20	μA	
I_{OZL}	Off-State Output Current, LOW Level Voltage Applied	$V_{IH} = \text{Min}$	$V_O = 0.4 \text{ V}$		-200	μA	
I_I	Input Current at Maximum Input Voltage	$V_{CC} = \text{Max}$	A or B $V_I = 5.5 \text{ V}$		0.1	mA	
			DIR or \bar{G} $V_I = 7 \text{ V}$		0.1		
I_{IH}	HIGH Level Input Current	$V_{CC} = \text{Max}, V_I = 2.7 \text{ V}$			20	μA	
I_{IL}	LOW Level Input Current	$V_{CC} = \text{Max}, V_I = 0.4 \text{ V}$			-0.2	mA	
I_{OS}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 3)		-40	-225	mA	
I_{CC}	Supply Current	$V_{CC} = \text{Max}$	Outputs HIGH		48	70	mA
			Outputs LOW		62	90	
			Outputs at Hi-Z		64	95	

Note 2: All typicals are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

Note 3: Not more than one output should be shorted at a time, not to exceed one second duration

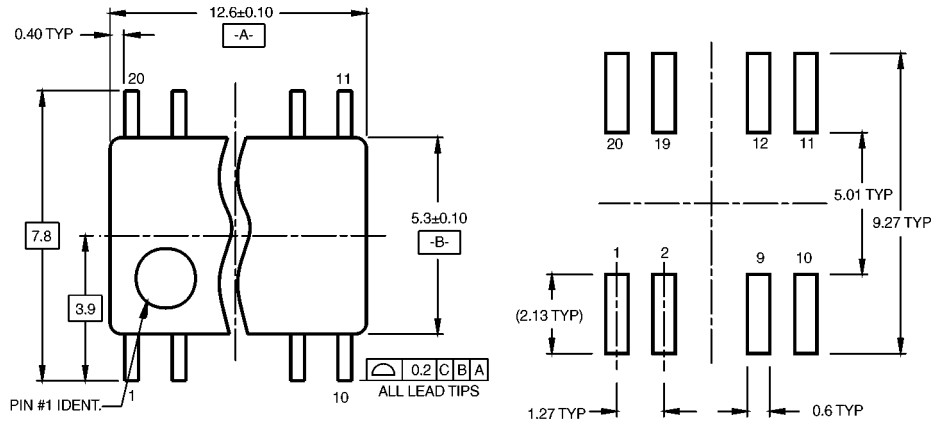
Switching Characteristics					
$V_{CC} = 5V, T_A = 25^\circ C$					
Symbol	Parameter	Conditions	Min	Max	Units
t_{PLH}	Propagation Delay Time, LOW-to-HIGH Level Output	$C_L = 45\text{ pF}$ $R_L = 667\Omega$		12	ns
t_{PHL}	Propagation Delay Time, HIGH-to-LOW Level Output			12	ns
t_{PZL}	Output Enable Time to LOW Level			40	ns
t_{PZH}	Output Enable Time to HIGH Level			40	ns
t_{PLZ}	Output Disable Time from LOW Level	$C_L = 5\text{ pF}$ $R_L = 667\Omega$		25	ns
t_{PHZ}	Output Disable Time from HIGH Level			25	ns
t_{PLH}	Propagation Delay Time, LOW-to-HIGH Level Output	$C_L = 150\text{ pF}$ $R_L = 667\Omega$		16	ns
t_{PHL}	Propagation Delay Time, HIGH-to-LOW Level Output			17	ns
t_{PZL}	Output Enable Time to LOW Level			45	ns
t_{PZH}	Output Enable Time to HIGH Level			45	ns

Physical Dimensions inches (millimeters) unless otherwise noted

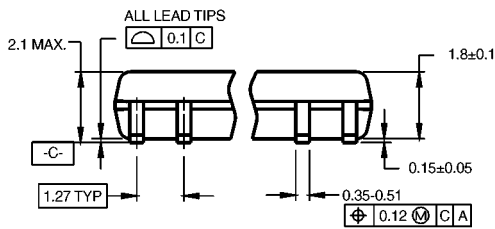


**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
Package Number M20B**

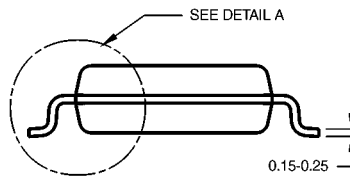
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION

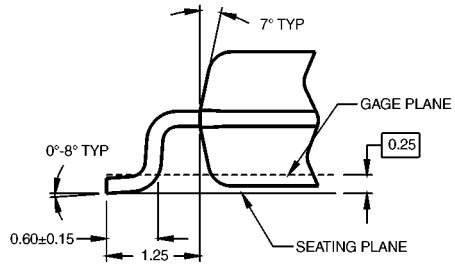


DIMENSIONS ARE IN MILLIMETERS



- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

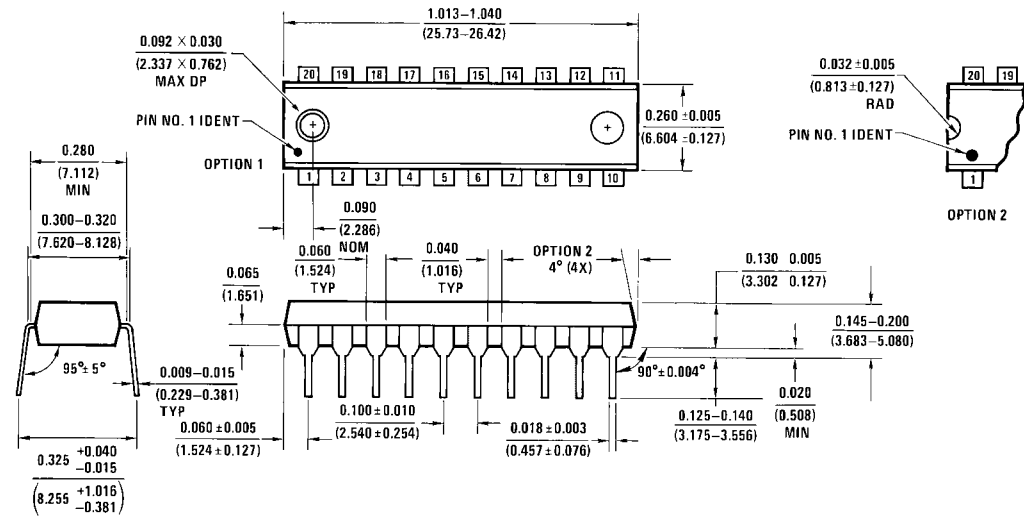
M20DRevB1



DETAIL A

**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



**20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N20A**

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DM74LS283

4-Bit Binary Adder with Fast Carry

General Description

These full adders perform the addition of two 4-bit binary numbers. The sum (Σ) outputs are provided for each bit and the resultant carry (C4) is obtained from the fourth bit. These adders feature full internal look ahead across all four bits. This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

The adder logic, including the carry, is implemented in its true form meaning that the end-around carry can be accomplished without the need for logic or level inversion.

Features

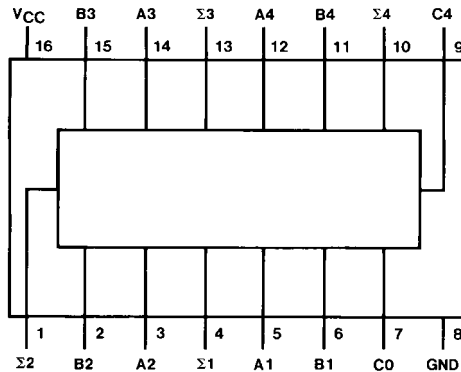
- Full-carry look-ahead across the four bits
- Systems achieve partial look-ahead performance with the economy of ripple carry
- Typical add times
 - Two 8-bit words 25 ns
 - Two 16-bit words 45 ns
- Typical power dissipation per 4-bit adder 95 mW

Ordering Code:

Order Number	Package Number	Package Description
DM74LS283M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS283N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			-0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = -18 mA			-1.5	V
V _{OH}	HIGH Level Output Voltage	V _{CC} = Min, I _{OH} = Max V _{IL} = Max, V _{IH} = Min	2.7	3.4		V
V _{OL}	LOW Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IL} = Max, V _{IH} = Min I _{OL} = 4 mA, V _{CC} = Min		0.35 0.25	0.5 0.4	V
I _I	Input Current @ Max Input Voltage	V _{CC} = Max V _I = 7V	A, B C0		0.2 0.1	mA
I _{IH}	HIGH Level Input Current	V _{CC} = Max V _I = 2.7V	A, B C0		40 20	μA
I _{IL}	LOW Level Input Current	V _{CC} = Max V _I = 0.4V	A, B C0		-0.8 -0.4	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max		-20	-100	mA
I _{CC1}	Supply Current	V _{CC} = Max (Note 4)		19	34	mA
I _{CC2}	Supply Current	V _{CC} = Max (Note 5)		22	39	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 4: I_{CC1} is measured with all outputs OPEN, all B inputs LOW and all other inputs at 4.5V, or all inputs at 4.5V.

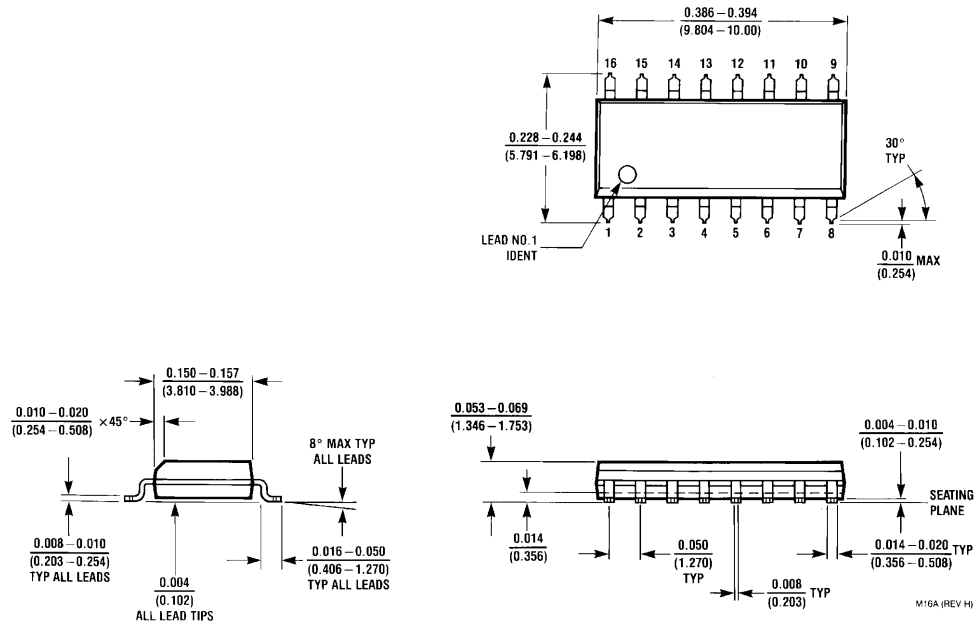
Note 5: I_{CC2} is measured with all outputs OPEN and all inputs GROUNDED.

Switching Characteristics

at $V_{CC} = 5V$ and $T_A = 25^\circ C$

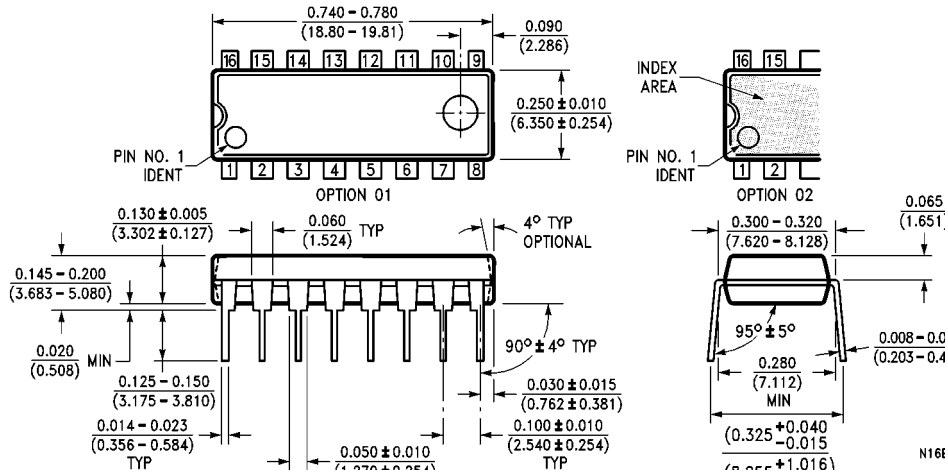
Symbol	Parameter	From (Input) To (Output)	$R_L = 2\text{ k}\Omega$				Units
			$C_L = 15\text{ pF}$		$C_L = 50\text{ pF}$		
			Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	C0 to $\Sigma 1, \Sigma 2$		24		28	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C0 to $\Sigma 1, \Sigma 2$		24		30	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	C0 to $\Sigma 3$		24		28	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C0 to $\Sigma 3$		24		30	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	C0 to $\Sigma 4$		24		28	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C0 to $\Sigma 4$		24		30	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	A_i or B_i to Σ_i		24		28	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	A_i or B_i to Σ_i		24		30	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	C0 to C4		17		24	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C0 to C4		17		25	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	A_i or B_i to C4		17		24	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	A_i or B_i to C4		17		26	ns

Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow Package Number M16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N16E

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DM74LS02

Quad 2-Input NOR Gate

General Description

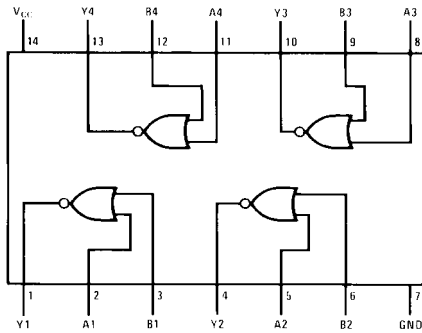
This device contains four independent gates each of which performs the logic NOR function.

Ordering Code:

Order Number	Package Number	Package Description
DM74LS02M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
DM74LS02SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS02N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

$$Y = \overline{A + B}$$

Inputs		Output
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

H = HIGH Logic Level
L = LOW Logic Level

Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			-0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = -18 mA			-1.5	V
V _{OH}	HIGH Level Output Voltage	V _{CC} = Min, I _{OH} = Max, V _{IL} = Max	2.7	3.4		V
V _{OL}	LOW Level Output Voltage	V _{CC} = Min, I _{OL} = Max, V _{IH} = Min		0.35	0.5	V
		I _{OL} = 4 mA, V _{CC} = Min		0.25	0.4	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 7V			0.1	mA
I _{IH}	HIGH Level Input Current	V _{CC} = Max, V _I = 2.7V			20	μA
I _{IL}	LOW Level Input Current	V _{CC} = Max, V _I = 0.4V			-0.40	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 3)	-20		-100	mA
I _{CCH}	Supply Current with Outputs HIGH	V _{CC} = Max		1.6	3.2	mA
I _{CCL}	Supply Current with Outputs LOW	V _{CC} = Max		2.8	5.4	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

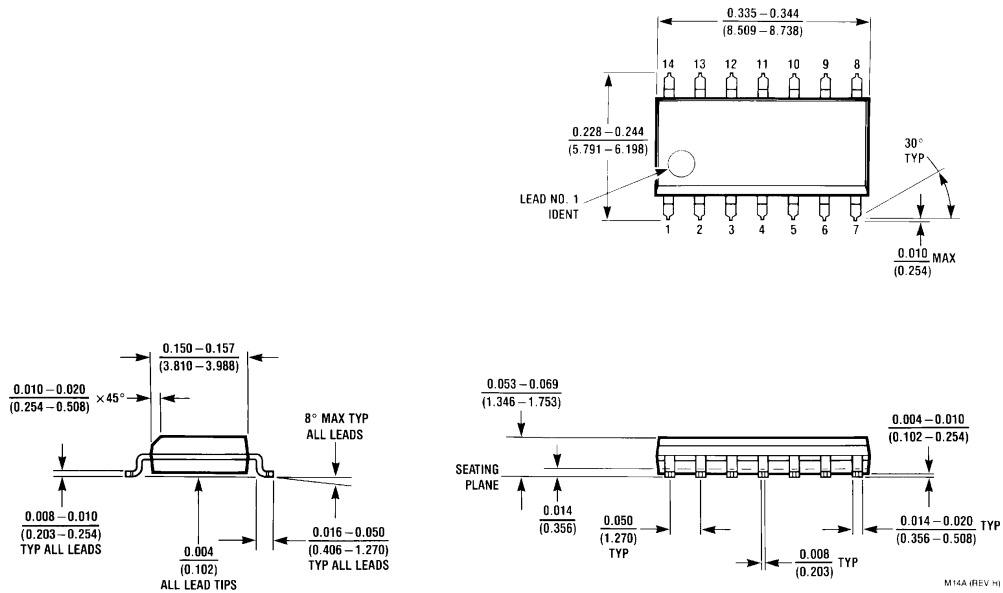
Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

at V_{CC} = 5V and T_A = 25°C

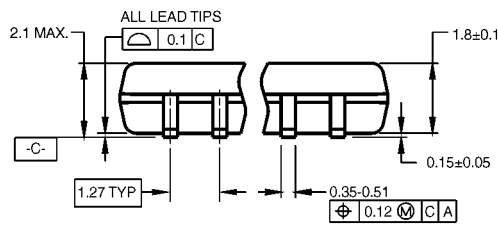
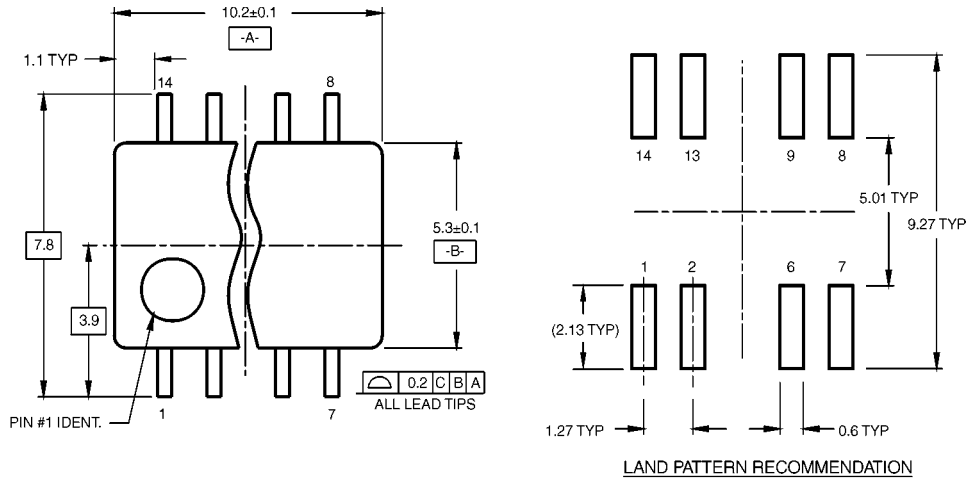
Symbol	Parameter	R _L = 2 kΩ				Units
		C _L = 15 pF		C _L = 50 pF		
		Min	Max	Min	Max	
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		13		18	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output		10		15	ns

Physical Dimensions inches (millimeters) unless otherwise noted



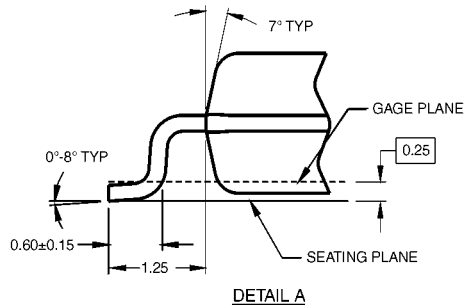
**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



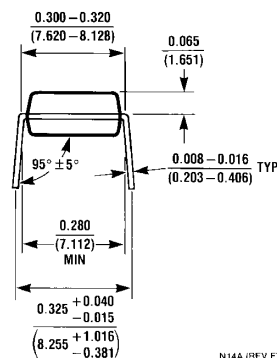
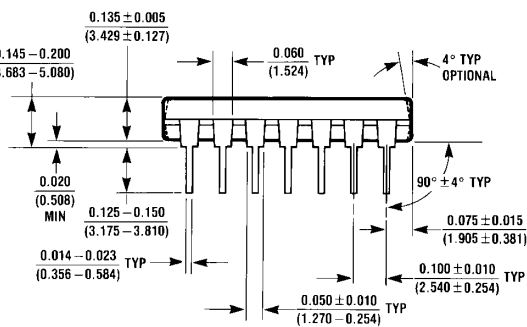
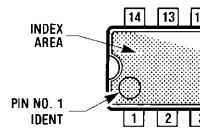
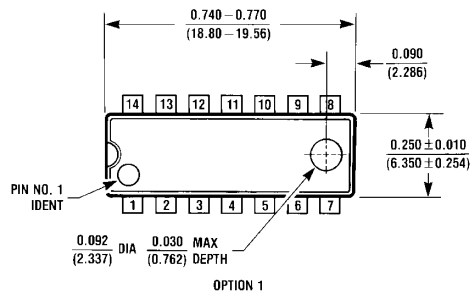
- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1



**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M14D**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



N14A (REV F)

14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N14A

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DM74LS08 Quad 2-Input AND Gates

General Description

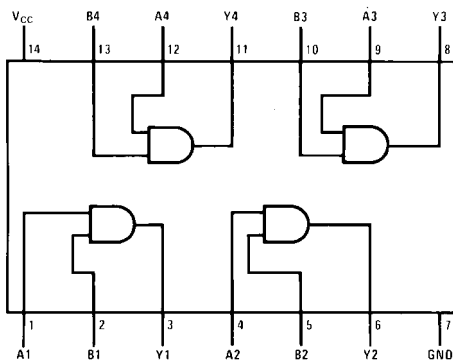
This device contains four independent gates each of which performs the logic AND function.

Ordering Code:

Order Number	Package Number	Package Description
DM74LS08M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
DM74LS08SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS08N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

$$Y = AB$$

Inputs		Output
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

H = HIGH Logic Level
L = LOW Logic Level

Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
I _{OH}	HIGH Level Output Current			-0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = -18 mA			-1.5	V
V _{OH}	HIGH Level Output Voltage	V _{CC} = Min, I _{OH} = Max, V _{IH} = Min	2.7	3.4		V
V _{OL}	LOW Level Output Voltage	V _{CC} = Min, I _{OL} = Max, V _{IL} = Max		0.35	0.5	V
		I _{OL} = 4 mA, V _{CC} = Min		0.25	0.4	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 7V			0.1	mA
I _{IH}	HIGH Level Input Current	V _{CC} = Max, V _I = 2.7V			20	μA
I _{IL}	LOW Level Input Current	V _{CC} = Max, V _I = 0.4V			-0.36	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 3)	-20		-100	mA
I _{CCH}	Supply Current with Outputs HIGH	V _{CC} = Max		2.4	4.8	mA
I _{CCL}	Supply Current with Outputs LOW	V _{CC} = Max		4.4	8.8	mA

Switching Characteristics

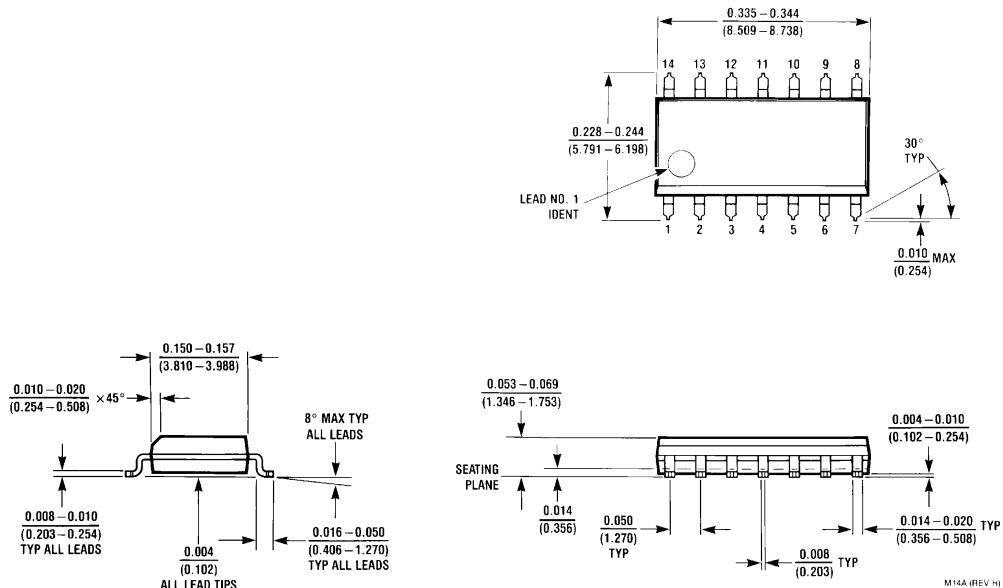
at V_{CC} = 5V and T_A = 25°C

Symbol	Parameter	R _L = 2 kΩ				Units
		C _L = 15 pF		C _L = 50 pF		
		Min	Max	Min	Max	
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	4	13	6	18	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	3	11	5	18	ns

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

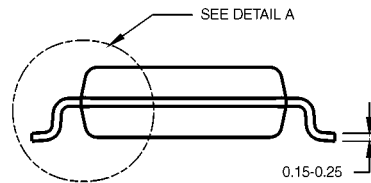
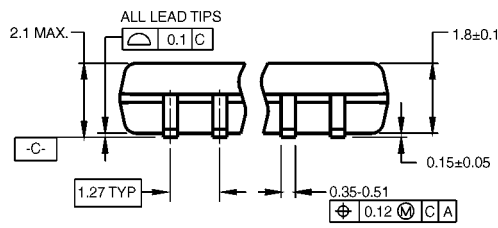
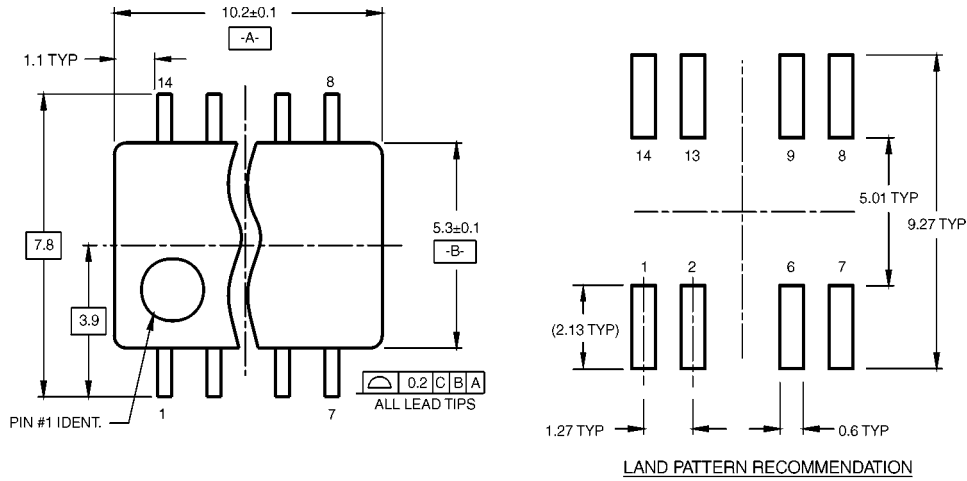
Physical Dimensions inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A**

M14A (REV H)

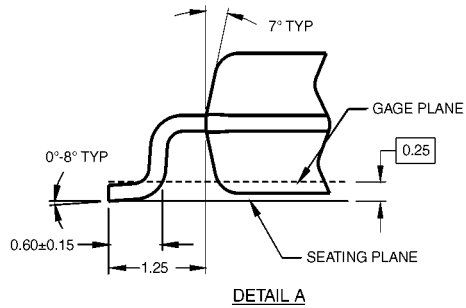
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

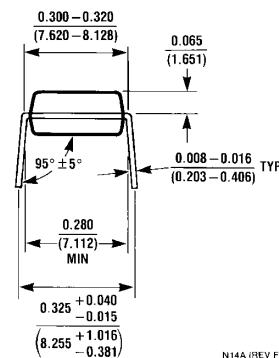
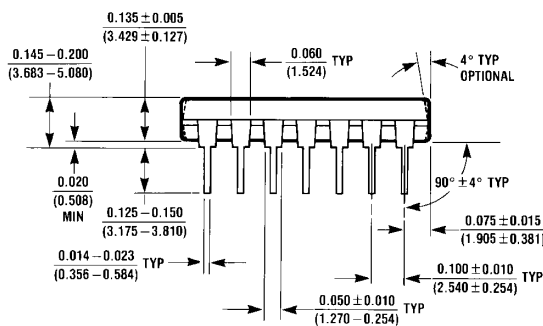
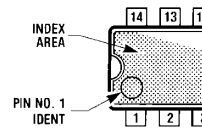
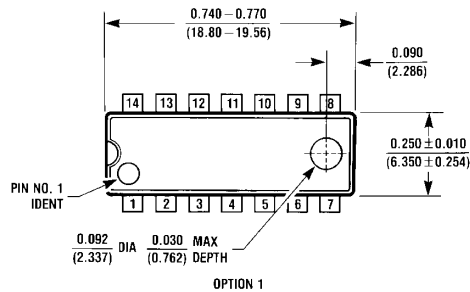
- NOTES:
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 B. DIMENSIONS ARE IN MILLIMETERS.
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1



**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
 Package Number M14D**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



N14A (REV F)

**14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N14A**

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